

**Remarks/Arguments**1. Amendments to the Claims

Applicants have: (a) amended claim 10 merely to make it more readable, and not for reasons related to patentability; (b) amended claim 23 to correct an inadvertent drafting error so that it depends from claim 21; and (c) added new claims 49-51 to more clearly define the present invention. No new subject matter has been introduced by these amendments.

2. Claim Objections

The Examiner objected to claims 22-23. Specifically, the Examiner stated:

Claims 22 and 23 are objected to because of the following informalities: If the another first layer is on the first material, how can the first material be etched while another layer is covering it? Appropriate corrected is required.

Claim 23 is objected to because of the following informalities: Claim 23, lacks antecedent basis for "the another layer" in the third line of the claim. Appropriate corrected is required.

Applicants have amended claim 23 to correct an inadvertent drafting error so that it depends from claim 21. As such, Applicants respectfully traverse the Examiner's rejection.

As to claims 22 and 23, both claims depend from claims 1 and 21. Claim 1 comprises a step of "removing at least portions of the second layer to extend the patterned features to the first layer" and a step of "removing at least portions of the first layer to extend the patterned features to the substrate." As such, in accordance with claims 22 and 23, the first layer is exposed at least in the sides of features, please refer to FIG. 5 in light of FIG. 3F. Also note that, as required by claim 21, the first layer includes one layer of the first material and the another layer of another material. Because of this, whenever the first layer is exposed in the sides of the features, the another layer and the one layer are exposed in the sides of the features. Hence, due to this exposure, the first material may be etched even though it is covered by the another layer.

As to claim 23, changing the inadvertent error in dependency has provided the antecedent basis for "the another layer."

In light of the above, Applicants respectfully request the Examiner to withdraw the objection to claims 22-23.

The Examiner objected to claims 18-20. Specifically, the Examiner stated:

Claims 18-20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Applicants respectfully traverse the Examiner's rejection.

Claims 18-20 depend from claim 1. Further, Applicants respectfully submit that, in light of the arguments presented below regarding claim 1, claim 1 is patentable. As such, Applicants respectfully submit that claims 18-20 are allowable in the present form.

In light of the above, Applicants respectfully request the Examiner to withdraw the objection to claims 18-20.

3. Claim Rejections

The Examiner rejected claims 1-8 and 12-17 under 35 U.S.C. 102(e). Specifically, the Examiner stated:

Claims 1-8 and 12-17 are rejected under 35 U.S.C. 102(e) as being anticipated by Sreenivasan et al. (US Patent Application Publication US 2004/0124566 A1).

The applied reference has a common inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

In re claim 1, Sreenivasan, in the US Patent Application Publication US 2004/0124566 A1; figures 1-41 and related text, discloses forming a first layer 18 on at least a portion of a surface of the substrate 20, the first layer including at least one layer of a first material, which one layer abuts the surface of the substrate; forming a second layer 44 of a second material on at least a portion of the first layer, which second layer is imprinted with the patterned features; removing at least portions of the second layer to extend the patterned features to the first layer (Figure 24B); removing at least portions of the first layer to extend the patterned features to the substrate (Figure 24C); wherein the first layer and the second layer may be exposed to an etching process that undercuts the patterned features, and the first material may be lifted-off (Figure 24D).

In re claim 2, Sreenivasan discloses wherein the etching process causes etching of the first material and no etching of the second material (Paragraph 0156).

In re claim 3, Sreenivasan discloses wherein the etching process causes etching of the first material and etching of the second material at a slower rate than a rate at which the first material is etched (Paragraph 0156).

In re claim 4, Sreenivasan discloses wherein the second layer does not intermix with the first layer (Paragraphs 0156 and 0157).

In re claim 5, Sreenivasan discloses wherein the step of removing at least portions of the second layer includes dry etching (Paragraph 0157).

In re claim 6, Sreenivasan discloses wherein the step of removing at least portions of the first layer to extend the patterned features to the substrate does not remove the second material (Figure 24C).

In re claim 7, Sreenivasan discloses wherein the first layer and the second layer are selectively etchable (Paragraph 0156).

In re claim 8, Sreenivasan discloses wherein the second layer includes a silicon-containing material and the first layer includes a non-silicon containing material (Paragraphs 0111 – 0114 and 0156).

In re claim 12, Sreenivasan discloses wherein the step of forming the second layer includes dispensing an acrylic-based polymerizable fluid (Paragraphs 0111 – 0114).

In re claim 13, Sreenivasan discloses wherein the acrylic-based polymerizable fluid includes (a) isobornyl acrylate; (b) n-hexyl acrylate; (c) ethylene glycol diacrylate; and (d) 2-hydroxy-2-methyl-1-phenyl-propan-1-one (Paragraphs 0111 – 0114).

In re claim 14, Sreenivasan discloses wherein the acrylic-based polymerizable fluid further includes a surfactant (Paragraph 0215).

In re claim 15, Sreenivasan discloses wherein the acrylic-based polymerizable fluid (a) isobornyl acrylate; (b) acryloxymethyltrimethylsilane; (c) (3-acryloxypropyltrimethylsiloxy) silane; (d) ethylene glycol diacrylate; and (f) 2-hydroxy-2-methyl-1-phenyl-propan-1-one (Paragraphs 0111 – 0114).

In re claim 16, Sreenivasan discloses wherein the acrylic-based polymerizable fluid further includes a surfactant (Paragraph 0215).

In re claim 17, Sreenivasan discloses wherein the UV initiator includes 2-hydroxy-2-methyl-1-phenyl-propan-1-one (Paragraphs 0111 – 0114).

Applicants respectfully traverse the Examiner's rejection.

In particular, as to claim 1, Applicants respectfully submit that Sreenivasan et al. does not teach a method "wherein the first layer and the second layer may be exposed to an etching process that undercuts the patterned features, and that the first material may be lifted off." Specifically, Sreenivasan et al. states the following at paragraph [0158]: "In FIG. 24C, portions 44 and etched portions of transfer layer 18 together form a masking stack 46 that may be used to inhibit etching of portions of the underlying substrate 20. ... An advantage of using a masking stack as a mask for etching of substrate 20 is that the combined stack of layers may create a high aspect ratio mask (i.e., a mask that has a greater height than width). A high aspect ratio masking layer may be desirable during the etching process to inhibit undercutting of the mask portions. (Emphasis added)

As the Examiner can readily appreciate from this, Sreenivasan et al. teaches away from the invention of claim 1 by teaching fabrication of a mask for use in etching a substrate using an anisotropic etch. The use of an anisotropic etch would not undercut the patterned features of the mask. As such, Sreenivasan et al. provides no disclosure or teaching whatsoever

of a first layer and a second layer "wherein the first layer and the second layer may be exposed to an etching process that undercuts the patterned features" in accordance with claim 1. In fact, because Sreenivasan et al. teaches away from use of an etch that would undercut "the patterned features" of a mask (since undercutting the patterned features of the mask would broaden the size of patterned features etched into substrate 20), Sreenivasan et al. provides no disclosure or teaching of first and second layers having properties in accordance with claim 1.

In sum, Sreenivasan et al. teaches creating an etch mask stack having straight walls that provides a mask for a subsequent anisotropic etching step, which mask stack inhibits undercutting of the substrate. Because of this, Sreenivasan et al. does not disclose or teach first and second layers that may be exposed to an etching process that undercuts the patterned features of the mask. In fact, Sreenivasan et al. teaches that such undercutting would produce an undesired result, i.e., broadened patterned features etched into the substrate. As such, Applicants respectfully submit that claim 1 is not anticipated by Sreenivasan et al.

As to claims 2-8 and 12-17, Applicants respectfully submit that claims 2-8 and 12-17 depend from claim 1, and that these claims are not anticipated by Sreenivasan et al. for the same reasons set forth above with respect to claim 1.

In light of the above, Applicants respectfully request the Examiner to withdraw the rejection of claims 1-8 and 12-17.

Examiner rejected claims 9-11 under 35 U.S.C. 103(a). Specifically, the Examiner stated:

Claims 9-11 are rejected under 35 U.S.C. 103(a) as being obvious over Sreenivasan as applied to claims 1-8 and 12-17 above, in further view of Wolf and Tauber (Silicon Processing for the VLSI Era Volume I: Process Technology).

The applied reference has a common inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome either by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). This rejection might also be overcome by showing that the reference is disqualified under 35 U.S.C.

103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(1) and § 706.02(1)(2).

In re claim 9, Sreenivasan discloses wherein the step of removing at least portions of the second layer to extend the patterned features to the first layer includes an anisotropic etch (Figure 24B and Paragraph 0155).

Sreenivasan does not disclose wherein the etching component includes a halogen component. However, Wolf and Tauber, in the textbook, Silicon Processing for the VLSI Era Volume 1: Process Technology discloses that  $\text{CF}_4$  is extensively used in the anisotropic (dry) etching of materials during VLSI fabrication (Page 541).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use  $\text{CF}_4$  as the halogen containing component of the etching of Sreenivasan, since, as taught by Wolf and Tauber,  $\text{CF}_4$  is widely used in the etching step of the VLSI fabrication.

In re claim 10, Wolf discloses wherein the anisotropic halogen etch is an anisotropic halogen reactive ion etch including a fluorine-containing precursor (Pages 541 and 542).

In re claim 11, Sreenivasan discloses etching the first material. Sreenivasan does not disclose wherein the etching is done by an oxygen plasma etch. Wolf and Tauber discloses that plasmas containing pure oxygen at moderate pressures attach (sic) organic materials to form  $\text{CO}$ ,  $\text{CO}_2$  and  $\text{H}_2\text{O}$  as end products. Oxygen plasma provide highly selective method for removing organic materials, since the  $\text{O}_2$  plasma do not etch  $\text{Si}$ ,  $\text{SiO}_2$ , or  $\text{Al}$  (Page 564).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use oxygen plasma etch to etch the first layer of Sreenivasan, since, as taught by Wolf and Tauber, oxygen plasma is highly selective at removing organic films.

Applicants have amended claim 10 merely to make it more readable, and not for reasons related to patentability. As such, Applicants respectfully traverse the Examiner's rejection.

In particular, as to claims 9-11, Applicants respectfully submit that claims 9-11 depend from claim 1. As set forth above, Sreenivasan et al. teaches creating an etch mask stack having straight walls that provides a mask for a subsequent anisotropic etching step, which mask stack inhibits undercutting of the substrate. In light of this, Applicants respectfully submit that Sreenivasan et al. provides no disclosure or teaching whatsoever of a first layer and a second layer "wherein the first layer and the second layer may be exposed to an etching process that undercuts the patterned features" in accordance with claim 1.

In addition, Applicants respectfully submit that nothing in the Wolf and Tauber reference provides a teaching to undercut a mask stack for any reason. Further, Applicants respectfully submit that even if one were to combine the teaching of Sreenivasan et al. and the Wolf and Tauber reference in the manner suggested by the Examiner, one would not arrive at the invention of claims 9-11 since there is no teaching in Sreenivasan et al. or in the Wolf and

Tauber reference for providing a first layer and a second layer “wherein the first layer and the second layer may be exposed to an etching process that undercuts the patterned features” in accordance with claim 1. As such, Applicants respectfully submit that claims 9-11 are patentable over Sreenivasan et al. in light of Wolf and Tauber.

In light of the above, Applicants respectfully request the Examiner to withdraw the rejection of claims 9-11.

Examiner rejected claims 21 and 24 under 35 U.S.C. 103(a). Specifically, the Examiner stated:

Claims 21 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sreenivasan as applied to claims 1-8 and 12-17 above, and further in view of Sakamoto et al. (US Patent Application Publication US 2005/0118749 A1).

In re claims 21 and 24, Sreenivasan discloses wherein the second layer does not intermix with the another layer (Paragraph 0156).

Sreenivasan does not disclose wherein the first layer includes the one layer and another layer of another material disposed on the one layer, and wherein the another layer is a BARC layer. Sakamoto, in the US Patent Application Publication US 2005/0118749 A1, discloses that BARC layers are placed under resist layers to protect the resist layer from random reflection and standing wave off the substrate (Paragraph 0002).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a BARC layer in the invention of Sreenivasan, since as taught by Sakamoto, a BARC layer protects the resist layer from random reflection and standing wave off the substrate.

Applicants respectfully traverse the Examiner’s rejection.

In particular, as to claims 21 and 24, Applicants respectfully submit that claims 21 and 24 depend from claim 1. As set forth above, Sreenivasan et al. teaches creating an etch mask stack having straight walls that provides a mask for a subsequent anisotropic etching step, which mask stack inhibits undercutting of the substrate. In light of this, Applicants respectfully submit that Sreenivasan et al. provides no disclosure or teaching whatsoever of a first layer and a second layer “wherein the first layer and the second layer may be exposed to an etching process that undercuts the patterned features” in accordance with claim 1.

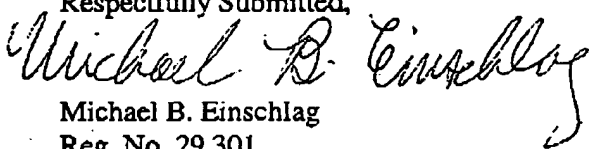
In addition, Applicants respectfully submit that nothing in Sakamoto et al. provides a teaching to undercut a mask stack for any reason. Further, Applicants respectfully submit that even if one were to combine the teaching of Sreenivasan et al. and Sakamoto et al. in the manner suggested by the Examiner, one would not arrive at the invention of claims 21 and 24

since there is no teaching in Sreenivasan et al. or in Sakamoto et al. for providing a first layer and a second layer "wherein the first layer and the second layer may be exposed to an etching process that undercuts the patterned features" in accordance with claim 1. As such, Applicants respectfully submit that claims 21 and 24 are patentable over Sreenivasan et al. in light of Sakamoto et al. In addition, Applicants respectfully submit that there is no motivation or suggestion to combine Sreenivasan et al. with Sakamoto et al. in the manner suggested by the Examiner since Sakamoto et al. relates to photolithography whereas Sreenivasan et al. relates to imprint lithography.

In light of the above, Applicants respectfully request the Examiner to withdraw the rejection of claims 21 and 24.

Applicants have added new claims 49-51 which depend from claim 1. As such, Applicants respectfully submit that new claims 49-51 are patentable over the cited references for the reasons set forth above.

Applicants respectfully request examination in view of the remarks. A notice of allowance is earnestly solicited.

Respectfully Submitted,  
  
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